

Attorney's Docket No.: 10559-867001/P17315
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35. (New) A photoresist comprising:

a lactone bonded to a polymer backbone, the lactone being reactable under semiconductor processing conditions and in the presence of an acid to undergo a ring-opening reaction and form an open ring structure without generating an organic species that can outgas in a vacuum environment, the lactone having a first group comprising $-CF_3$ attached to the carbon bonded to the lactone carbonyl oxygen.

REMARKS

Claims 1-35 are pending. Claims 1, 21, 25, and 33-35 are in independent form.

In the action mailed February 27, 2006, claims 10 and 12 were identified as being allowable if placed in independent form. In response thereto, new claims 34 and 35 have been added to recite subject matter drawn therefrom. Allowance of new claims 34 and 35 is thus respectfully requested.

Claims 1 and 33

Claims 1 and 33 were rejected under 35 U.S.C. § 102(b) as anticipated by Japanese Patent Publication No. 2002-082441 by Yoon et al. (hereinafter "Yoon").

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Claim 1 relates to a photoresist. The photoresist includes a polymer backbone, a lactone bonded to the polymer backbone, and a side chain bonded to the polymer backbone. The lactone is reactable under semiconductor processing conditions and in the presence of an acid to undergo a ring-opening reaction and form an open ring structure to switch a solubility of the photoresist in a developer without generating an organic species that can outgas in a vacuum environment. The side chain includes a styrene ring.

Claim 33 relates to a photoresist that includes a polymer backbone, a lactone fused to the polymer backbone, the lactone comprising a tertiary carbon bonded to the lactone carbonyl oxygen, and a styrene ring side chain bonded to the polymer backbone. Sufficient lactone is fused to the polymer backbone so that a ring-opening reaction of the lactone to form an open ring structure suffices to switch a solubility of the photoresist in a developer.

Yoon neither describes nor suggests such photoresists. In particular, Yoon neither describes nor suggests a photoresist that includes a side chain having a styrene ring and bonded to the polymer backbone, as recited in claims 1 and 33. Indeed, Yoon describes a very large number of polymers and side chains

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but Applicant is unable to identify any of Yoon's side chains that include a styrene ring.

Accordingly, claims 1, 33, and the claims dependent therefrom, are not anticipated by Yoon and the rejections should be withdrawn.

Claim 21

Claim 21 was rejected under 35 U.S.C. § 102(b) as anticipated by Yoon.

Claim 21 relates to a method that includes forming a photoresist having a polymer backbone and a lactone bonded to the polymer backbone, and switching the solubility of the photoresist in a developer by exposing the lactone to an acid catalyst under vacuum, thereby causing the lactone to undergo a ring opening reaction upon exposure to the acid catalyst without molecules outgassing from the photoresist. The lactone includes a tertiary carbon bonded to the lactone carbonyl oxygen.

Yoon neither describes nor suggests switching the solubility of the photoresist in a developer by exposing the lactone to an acid catalyst under vacuum, thereby causing the lactone to undergo a ring opening reaction upon exposure to the acid catalyst without molecules outgassing from the photoresist, as recited in claim 21.

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In this regard, Yoon describes a number of different resists that include annular lactones. See, e.g., Yoon, para. [0016], [0042], [0081]. Some of these annular lactones have a tertiary carbon bonded to the lactone carbonyl oxygen. See, e.g., Yoon, para. [0081].

Yoon's annular lactones are generally understood to be part of a photoresist that includes at least one comonomer. See Yoon, para. [0018]. The presence of a comonomer is understood to be required of even the annular lactones that have a tertiary carbon bonded to the lactone carbonyl oxygen. See Yoon, para. [0143], [0150].

One source of Yoon's primary comonomers are acrylates and methacrylates. See Yoon, para. [0026]. The constituents from the acrylate and methacrylate monomers are generally present in relatively large percentages in Yoon's resists. See, e.g., Yoon, para. [0028] (describing that $p/(m+p+q)$ is between 0.1 and 0.6), para. [0029] (describing that $p/(m+p+q)$ is between 0.1 and 0.6), para. [0030] (describing that $p/(m+n+p+q)$ is between 0.1 and 0.6), para. [0036] (describing that $p/(m+p+q+r)$ is between 0.1 and 0.6), para. [0038] (describing that $p/(n+p+q+r)$ is between 0.1 and 0.6), para. [0040] (describing that $p/(m+n+p+q+r)$ is between 0.1 and 0.6).

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These acrylate and methacrylate constituents are also understood to be present in relatively large percentages in Yoon's resists that include annular lactones having a tertiary carbon bonded to the lactone carbonyl oxygen. For example, in Formula 65, Yoon denotes moles of annular lactone having the claimed tertiary carbon as "k" and moles constituents from acrylate/methacrylate as "p." See Yoon, para. [0143]. The ratio of $k/(k+p)$ is understood to be between 0.3 and 0.8. See Yoon, para. [0054]. The moles of the various comonomers is similarly denoted in Formula 66.

Applicant respectfully submits that such acrylate and methacrylate constituents are the mechanism by which Yoon's photoresists achieve the necessary solubility switching. Moreover, such constituents will generally generate volatile organic species upon exposure to acid. In this regard, attention is respectfully directed to FIG. 3B of the present application and the written description thereof. Moreover, there is no indication that Yoon can achieve the necessary solubility switching absent these constituents.

Since Yoon's photoresists are all understood to achieve the necessary solubility switching, at least in part, using constituents derived from acrylates/methacrylates and to outgas upon exposure to acid, claim 21 is not anticipated by Yoon. In

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particular, Yoon neither describes nor suggests switching the solubility of the photoresist in a developer by exposing the lactone to an acid catalyst under vacuum, thereby causing the lactone to undergo a ring opening reaction upon exposure to the acid catalyst without molecules outgassing from the photoresist, as recited in claim 21.

Accordingly, Applicant requests that the rejections of claim 21 and the claims dependent therefrom be withdrawn.

Claim 25

Claim 25 was rejected under 35 U.S.C. § 103(a) as obvious over Yoon and U.S. Patent No. 6,680,157 to Fednyshyn (hereinafter "Fednyshyn").

Claim 25 relates to a method that includes radiating an area of a chemically amplified photoresist in a vacuum environment to generate an acid within the photoresist, and catalyzing a ring-opening reaction in the photoresist. The ring-opening reaction suffices to switch the solubility of the photoresist in a developer without the generation of molecules that outgas from the photoresist in the vacuum environment.

The rejection of claim 25 contends that the combination of Yoon and Fednyshyn would yield the recited subject matter. Applicant respectfully disagrees. In particular, neither Yoon nor Fednyshyn describes or suggests catalyzing a ring-opening

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reaction that suffices to switch the solubility of a photoresist in a developer without the generation of molecules that outgas from the photoresist, as recited in claim 25.

In this regard, as discussed above, Yoon's photoresists are all understood to achieve the necessary solubility switching, at least in part, by cleaving comonomer acrylates/methacrylates. Accordingly, any ring-opening reaction undergone by Yoon's photoresists does not suffice to switch the solubility of the photoresist in a developer, as recited in claim 25.

Fednyshyn does nothing to remedy this deficiency in Yoon since Fednyshyn specifically identifies that outgassing can be reduced or eliminated without resorting to the use of ring-opening reactions to switch solubility. In this regard, Fednyshyn describes that aromatic compounds can be mixed with resin compositions to reduce outgassing. See, e.g., *Fednyshyn*, col. 2, line 10-13. Fednyshyn indicates that almost any resin composition "available to those of ordinary skill in the art" can be used. See *Fednyshyn*, col. 7, line 26-29. Fednyshyn also explicitly identifies that acrylate based polymers and methacrylate based polymers are "suitable examples." See *Fednyshyn*, col. 7, line 33-35.

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As to the aromatic compounds, Fednyshyn identifies that any of a large number of different suitable aromatic compounds will reduce or even eliminate outgassing. See, e.g., Fednyshyn, col. 5, line 52 - col. 6, line 21. Fednyshyn also makes it clear that whatever compound is chosen must be able to act as "radical scavengers or have the ability to form stabilizing (or stabilized) radicals." See, e.g., Fednyshyn, col. 4, line 66 - col. 5, line 2.

Applicant submits that one of ordinary skill, upon combining Fednyshyn and Yoon, would not arrive at the claimed subject matter. In this regard, Fednyshyn would induce one of ordinary skill to use aromatic compounds to scavenge radicals in resins that include the acrylate and methacrylate co-monomers described by Yoon. Simply put, Fednyshyn makes it clear that there is no reason for one of ordinary skill to catalyze a ring-opening reaction to switch the solubility, as recited in claim 25.

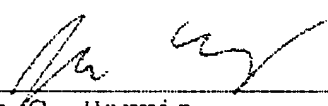
Accordingly, claim 25 is not obvious over Fednyshyn and Yoon. Applicant thus requests that the rejections of claim 25 and the claims dependent therefrom be withdrawn.

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Applicant asks that all claims be allowed. No fees are believed due at this time. Please apply any charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

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